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Breeding Hardy Fruits

N.E. Hansen

South Dakota Agricultural College

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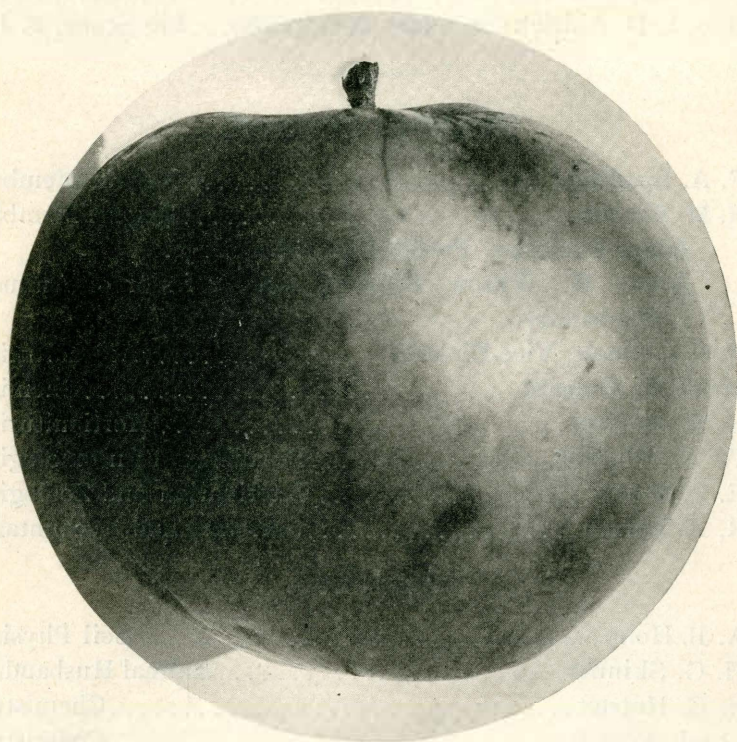
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Bulletin No. 88.

June, 1904.

South Dakota
Agricultural College
EXPERIMENT STATION



Breeding Hardy Fruits

N. E. HANSEN

DEPARTMENT OF HORTICULTURE

BROOKINGS, SOUTH DAKOTA

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BREEDING HARDY FRUITS.

N. E. HANSEN, HORTICULTURIST.

Over a large area of the prairie northwest, many of the fruits grown in the eastern and southern states are deficient in hardiness. This has been demonstrated by thousands of planters. The climatic extremes of the northwestern prairies do not make fruit culture impossible; but care must be taken in the selection of varieties. The fruit lists adopted by the various state horticultural societies give the general experience with varieties. The beginner should confine his first main planting to the sorts which have stood the test, but often the list is so short that the varieties recommended for trial are needed to fill out the list. There is need of extending the present short list of fruits. Successful fruit culture is essential to true home-making upon the open prairies, hence the work of originating hardy fruits is of the highest possible importance.

It is only in recent years that the immense importance of plant-breeding has become generally recognized. Plant-breeding means the originating of improved varieties by selection, crossing and hybridizing. These are often termed "new creations," and the work corresponds to that of invention in the domain of the mechanical industries. A strictly hardy winter apple, a hardy cherry, or a hardy grape of large size and good quality, would be worth millions of dollars to the prairie northwest.

For the benefit of the general reader it should be stated that fruit trees, shrubs and plants usually vary greatly from seed so that no two are exactly alike. For example, from one thousand trees raised from seed of the same variety of apple, even from the same tree, no two trees will be exactly alike as to character of fruit. Of all these, usually very few are worthy of propagation; sometimes only one; sometimes none. Any variety proving especially desirable as to size, quality and productiveness, may be given a name and as many more plants obtained as desired by budding, grafting or other mode of division. Many of the standard varieties of orchard and small fruits in cultivation today are chance productions of unknown origin. Some say that all such work should be left to chance. But waiting for nature to do all the work is not favored by the most advanced workers in this line. Plants can be improved by crossing and selection the same as animals. In the breeding of plants many of the same laws apply which hold in the breeding of animals. One of the most interesting of recent developments in this work, is that plants can be bred resistant and immune to various fungus and insect enemies. This is illustrated by the recent work of the United States Department of Agriculture in originating new varieties of cotton proof against the destructive cottonwilt.

In beginning work as horticulturist at this Experiment Station in September, 1895, the writer began an extended series of experiments in plant-breeding by collecting plants of the leading native wild fruits of the state. From time to time as these plants came into bearing, seed was saved from the plants bearing the best fruit. Seedlings were also raised from samples of fresh wild fruit obtained from various parts of the Dakotas, Manitoba and Assiniboia. In the course of a ten months trip (June 1897, March 1898) as Agricultural Explorer for the United States Department of Agriculture in European and Asiatic Russia, additional material for this work was obtained. In the report for the fiscal year ending June 30, 1901, the progress in fruit-breeding was recorded as follows: "During the past two years over twenty-seven thousand seedlings of native fruits have been raised in this department in the hope of originating new and improved varieties. The following list shows in round numbers the seedlings at digging time last fall. These have been set in plantations for fruiting and a large proportion of the strawberries, currants, gooseberries and sand cherries give promise of bearing fruit this year.

LIST OF SEEDLINGS.

Sand cherry, 8,400; plum, 4,000; grape, 5,000; wild strawberry, crossed with tame, 5,000; strawberry, pure native, 1,000; pin cherry, 25; choke cherry, 360; golden currant, 200; black currant, 2,200; buffalo berry, 180; gooseberry, 425; wild raspberry, crossed with tame, 200; raspberry, pure native, 40; total, 27,030."

Since this time the work has steadily increased in magnitude until the number of seedlings has reached fully one quarter of a million. Many thousands of seedlings are raised each year of which the best few are saved, the remainder destroyed by fire. Some varieties of much promise have been obtained and are now under propagation for trial elsewhere.

THE TWO LINES OF WORK.

The work of fruit-breeding is along two lines: 1st, By selection from large numbers of seedlings from selected plants; 2nd, By crossing or hybridizing with cultivated varieties, the aim being to combine the hardiness of the wild plants with the size and quality of fruit of the tame.

FOREIGN IMPORTATIONS.

In addition considerable work is being done in importing fruits from countries of the old world with a similar climate. These also add to the material used in plant-breeding. At this stage of the experiment it appears desirable to give a brief outline of the work under way. The space available will not permit of a full discussion at this time, nor would it be of general interest. The following illustrations will perhaps give a better general idea of the work than many pages of description:

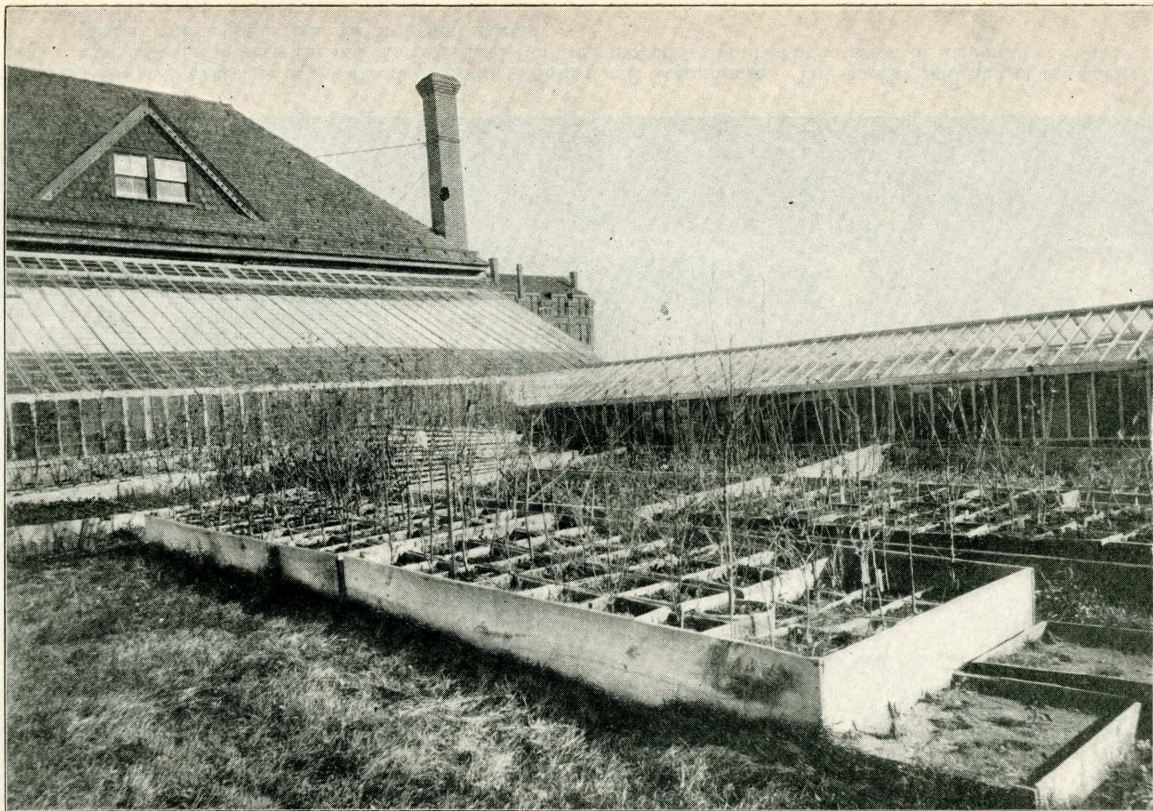


Plate 2—Showing the beginning of the plant-breeding work with potted trees at the South Dakota Experiment Station. Photograph taken November 1, 1899, after the leaves had fallen.

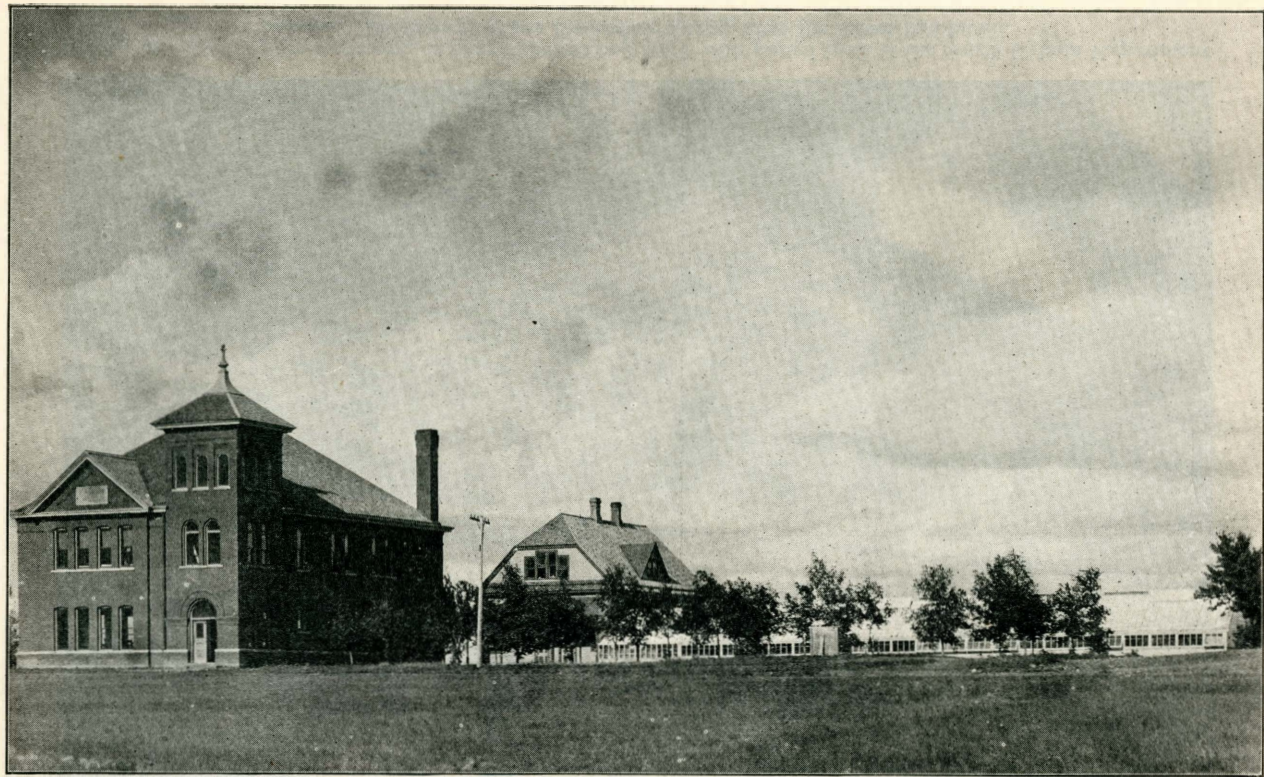


Plate 3—View of west side of the Plant-Breeding Building and Greenhouse. The smaller building at the north end of the Greenhouse is the old Horticultural Building moved to its present location in the summer of 1901, the year in which the larger building was erected.

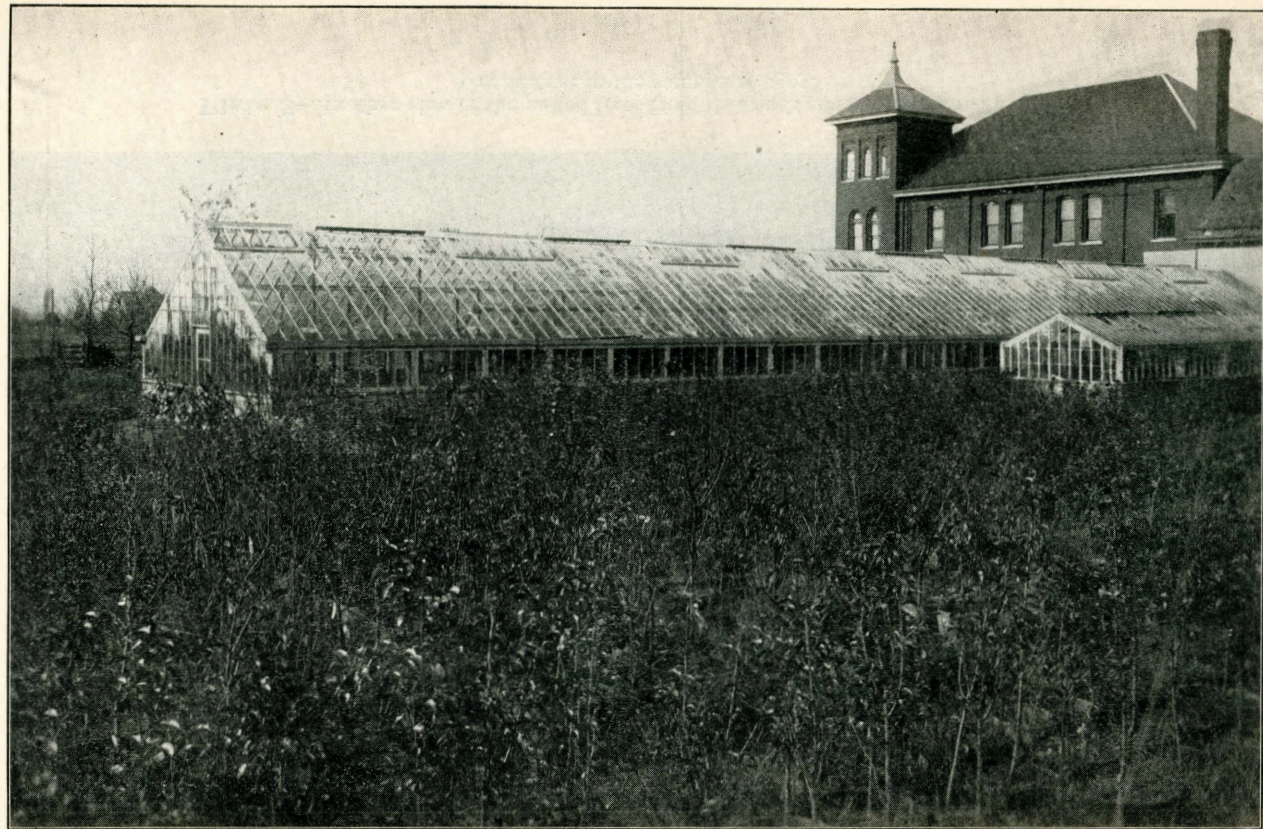


Plate 4—View on southeast side of Plant-Breeding Building showing the summer arrangement in 1902-04 of the potted trees used in plant-breeding.

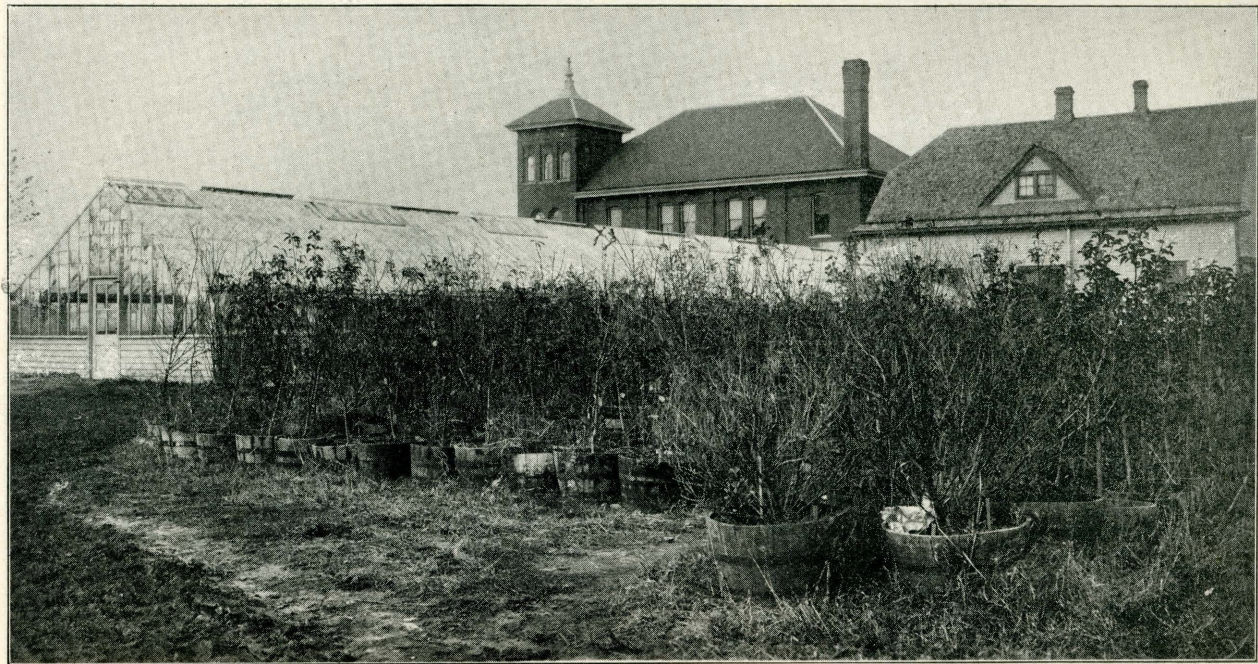


Plate 5—Another view of the potted trees from the south end of the Plant-Breeding Greenhouse in the summer of 1903.



Plate 6—Crossing wild with tame strawberries under glass. On the left side is seen the apple graft-hybrids with arrangement for shading. These trees were afterwards transplanted to the open field.



Plate 7—Showing method of crossing fruits under glass. Sometimes a small sharp knife is used in the work instead of pincers. The method is one demanding close attention and special care to insure success.



Plate 8—A young De Soto plum on Sand Cherry stock in blossom as a potted tree. When planted outdoors these dwarf trees are equally precocious in their blossoming and fruiting and hence desirable in the small amateur garden when kept in bush form instead of being trimmed up with a tall stem.



Plate 9—The Kieffer pear in bearing as a dwarf tree.



Plate 1C—The Red June, a Japanese plum, on Sand Cherry stock, fruiting heavily as a potted tree under glass.

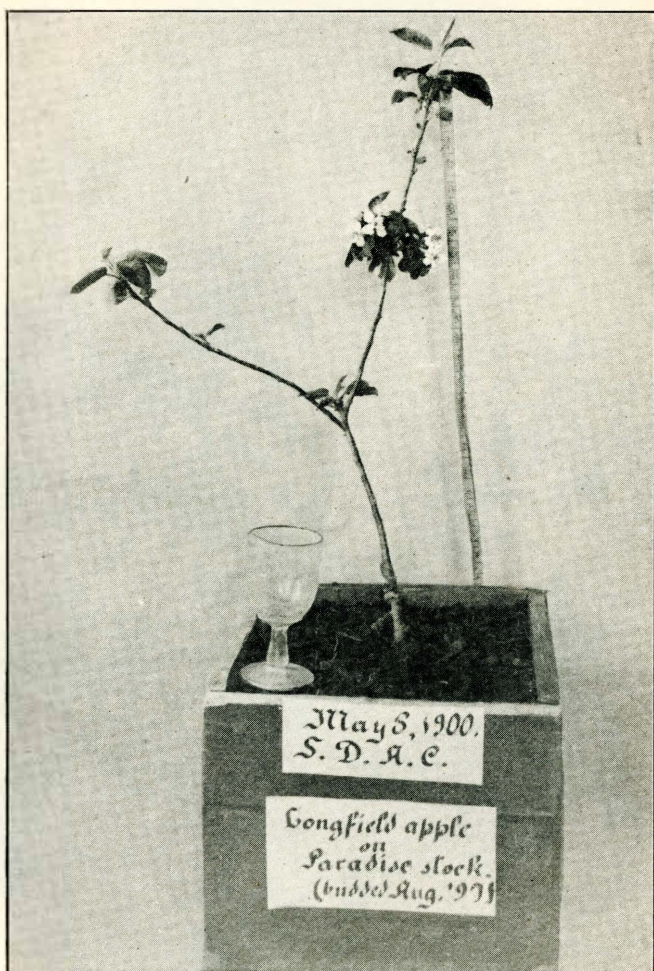


Plate 11—The Paradise stock is used in breeding apples. This plate shows a tree of Longfield budded in August, 1897, which blossomed as a potted tree in May, 1900. The Paradise apple is not sufficiently hardy at the north, hence the trees in nursery row are mulched heavily over winter with coarse stable manure. The fruit produced on these dwarf trees is of fine quality and of extra size. This method is recommended to apple breeders as one worthy of trial.

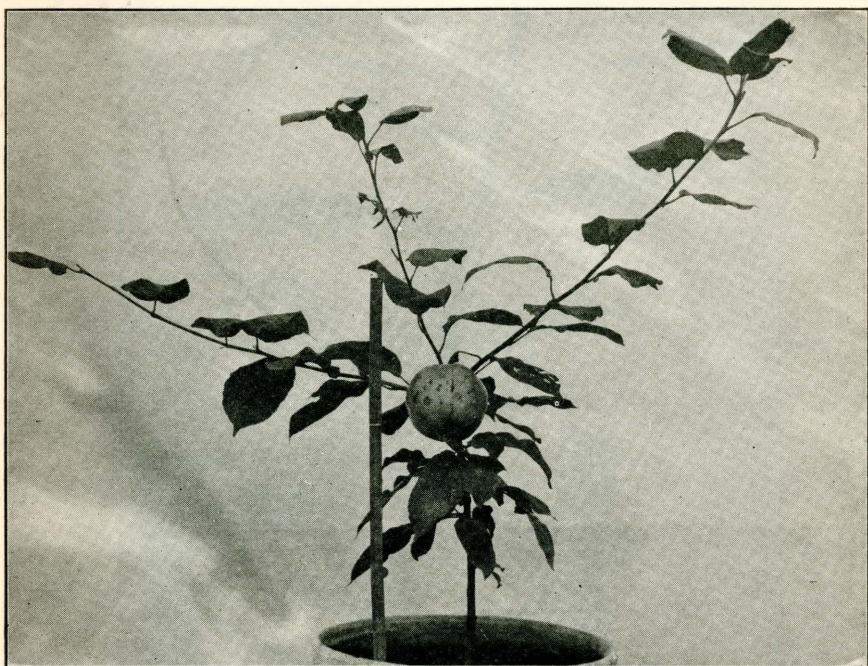


Plate 12—An extreme example of dwarfing the apple, showing the Hibernian bearing as a one year tree from the bud on Paradise stock. In Plate 1, the frontispiece, is shown this same specimen of natural size.

DWARF APPLE TREES.

The Paradise Apple is used extensively in Europe as a stock for dwarf apple trees. These trees bear early and abundantly and the fruit is larger than on "standard" trees, by which is meant those on common apple stock. The Paradise Apple is used but little in the United States since land is cheaper and the extensive apple orchards of the west keep pace in area with the increase of population.

The Doucin is a larger growing tree used for semi-dwarf trees, especially espaliers and other artificial forms. It appears to be the "Broad-leaved Paradise" of some English nurseries. Both the Paradise and Doucin have been given a thorough trial at the South Dakota Experiment Station as a stock for dwarf orchards, with a view to planting these trees closer together and make spraying convenient, but neither have proved sufficiently hardy.

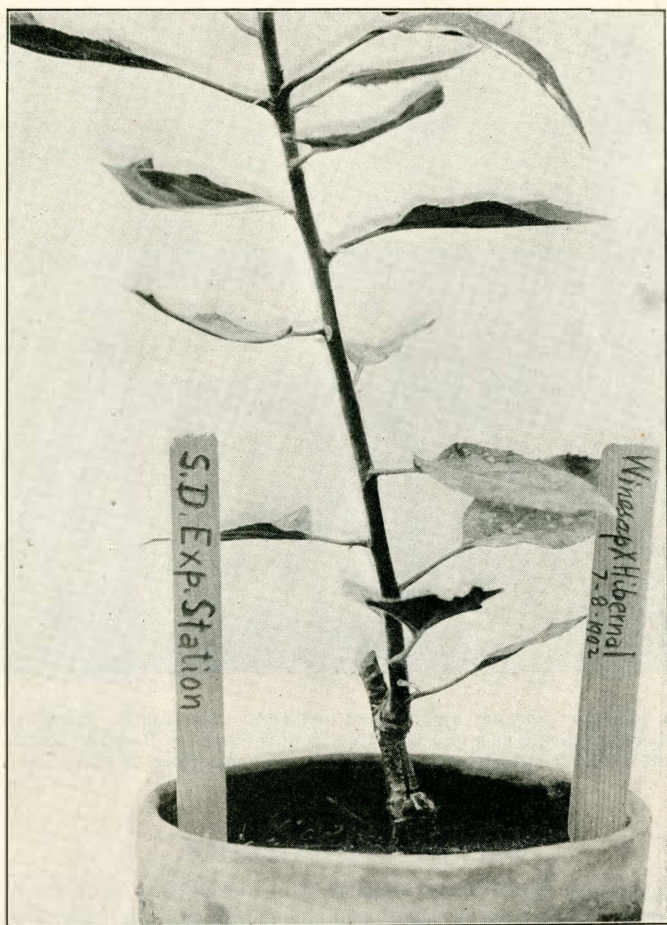


Plate 13—A Graft-Hybrid of the apple. In the winter of 1901-02 an extended series of experiments was undertaken at this Station to produce new varieties of apples by splitting two scions through the bud and uniting the corresponding halves of the two varieties. One of the successful hybrids is illustrated in this cut. It will be impossible to predict the character of the fruit from these trees; their fruiting is awaited with interest. The scions containing one bud are inserted by side-grafting upon whole roots of common apple seedlings. It is a work demanding great care and exactness of manipulation and the method is not recommended to the amateur. The use of glass has been found necessary by the present writer in this work.



Plate 14—Seventeen varieties of new hybrid strawberries produced at this Station by crossing the wild with the tame varieties.

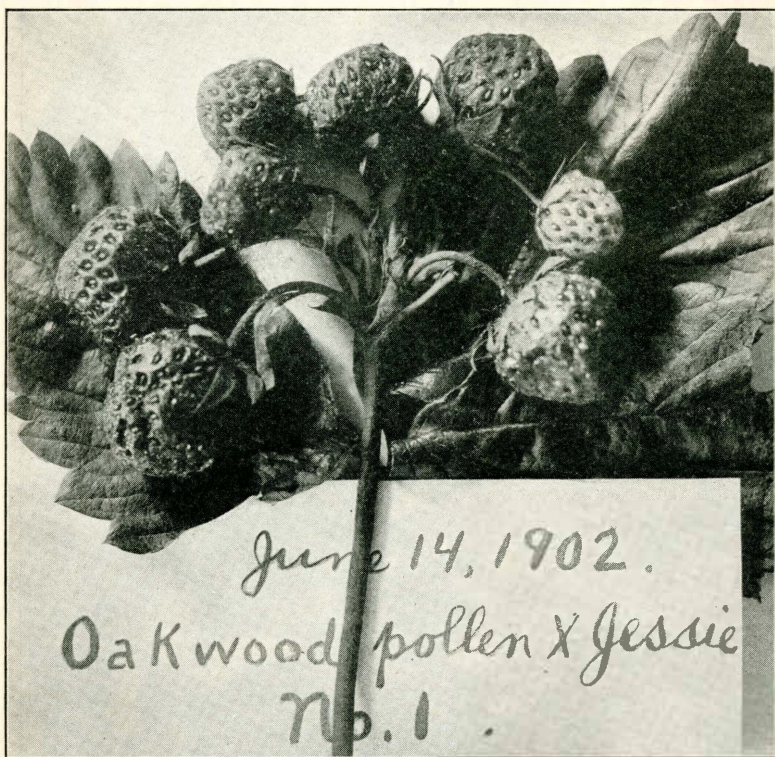


Plate 15—First fruits of a hybrid strawberry produced by crossing the Jessie with pollen of the wild strawberry from Lake Oakwood about eighteen miles northwest of the South Dakota Experiment Station. Considerable progress has been made at this Station in crossing the wild strawberries of North and South Dakota, Manitoba and Assiniboia with the best tame varieties, including everbearing strawberries from France. From 8,000 cross-bred plants some 225 varieties were selected and increased to over 14,000 plants which were set in field in the spring of 1903. The best of these will be distributed for trial elsewhere.

ACKNOWLEDGMENT.

The photographs for the twenty-nine cuts in this bulletin were taken as follows: Twenty-one (Nos. 1, 3, 4, 7, 9, 10, 12, 19, 21, 23, 24, 28, 29,) by A. B. Holm, photographer of this Station; eight, (Nos. 2, 8, 11, 20, 22, 25, 27,) by W. S. Thornber of this Department.

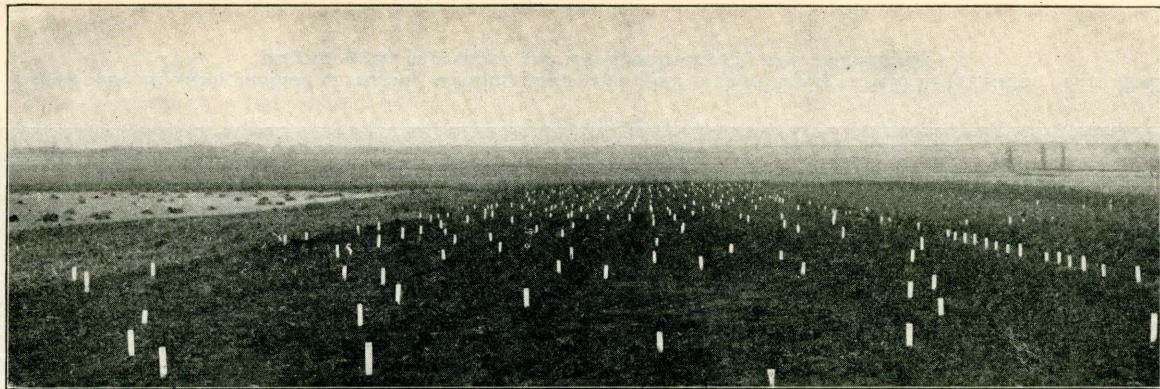


Plate 16—Showing western part of the fruit-breeding nursery in the fall of 1903.

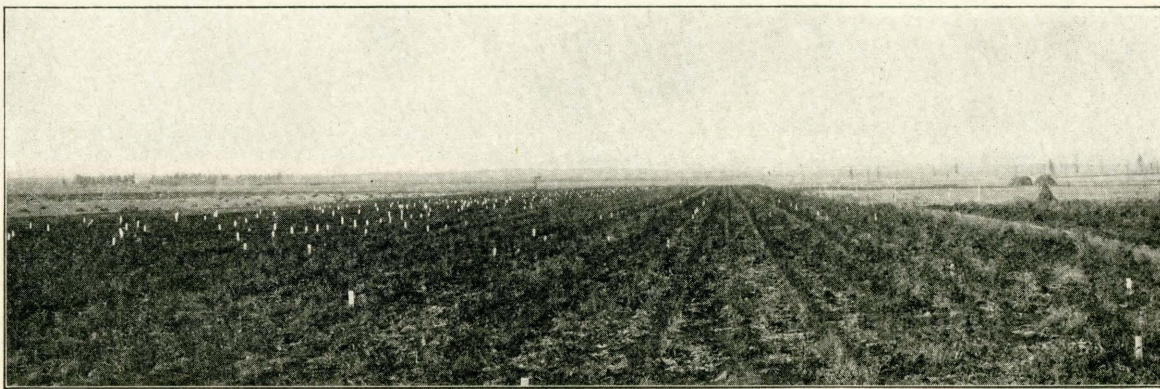


Plate 17—Showing eastern part of the fruit-breeding nursery in the fall of 1903.

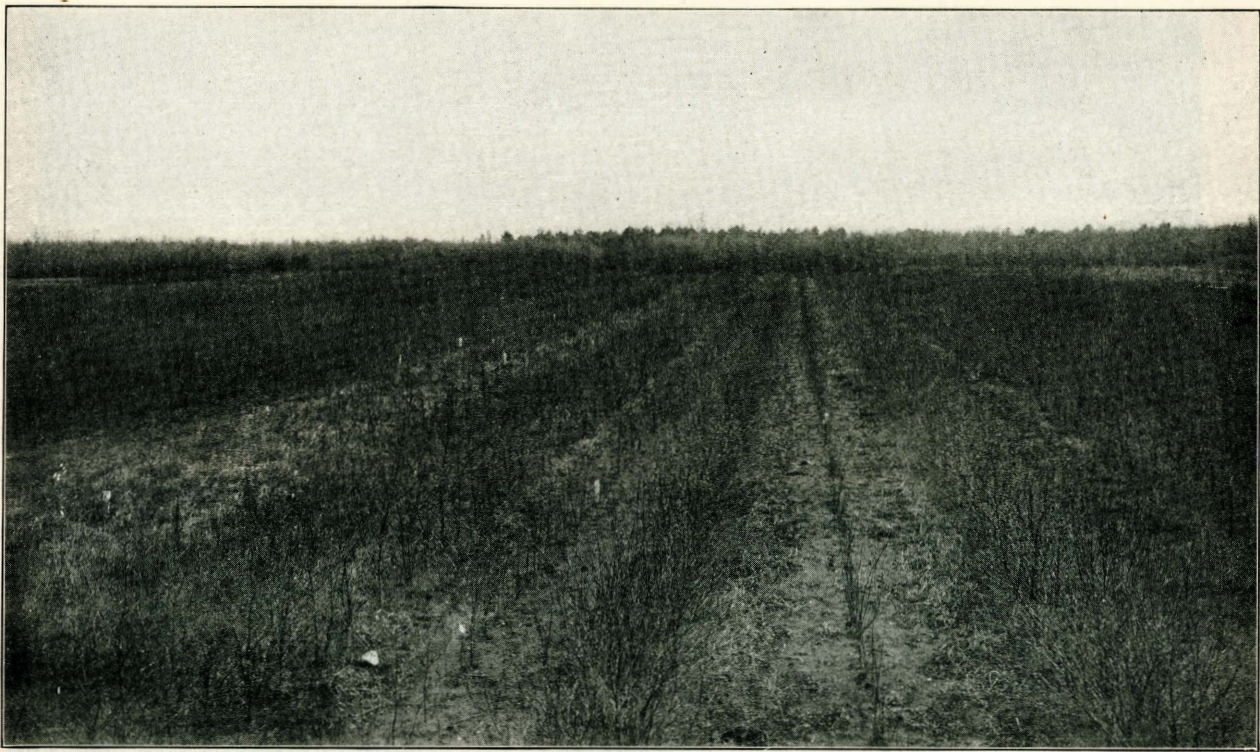


Plate 18—Showing method of fruiting seedling plums and other orchard fruits in field hedge rows. This method permits ready cultivation and the trees bear early and abundantly.



Plate 19—A field of 7,500 Buffalo Berries of the first generation under cultivation. These plants are from seed gathered along the Missouri river of South Dakota.

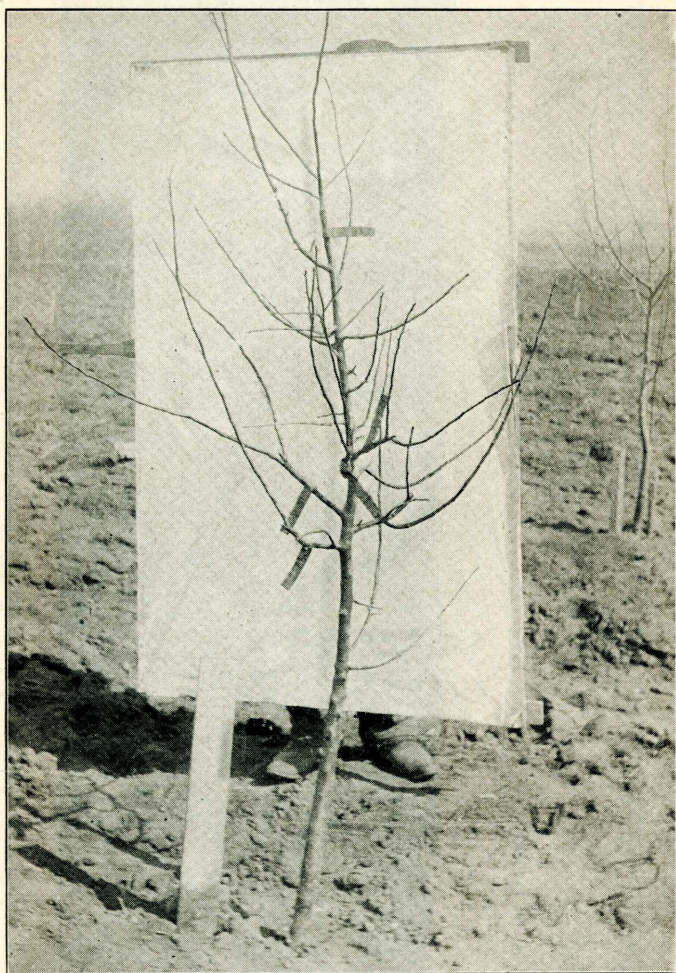


Plate 20—Illustrating one of the methods of securing fruit from any new seedling apple. Young orchard trees of some hardy variety are top-worked by budding or grafting with the new seedling. In top-grafting the scions are inserted in the branches as indicated by the six labels in the above plate. This secures the hardy stem and strong fork of the variety selected as the stock.

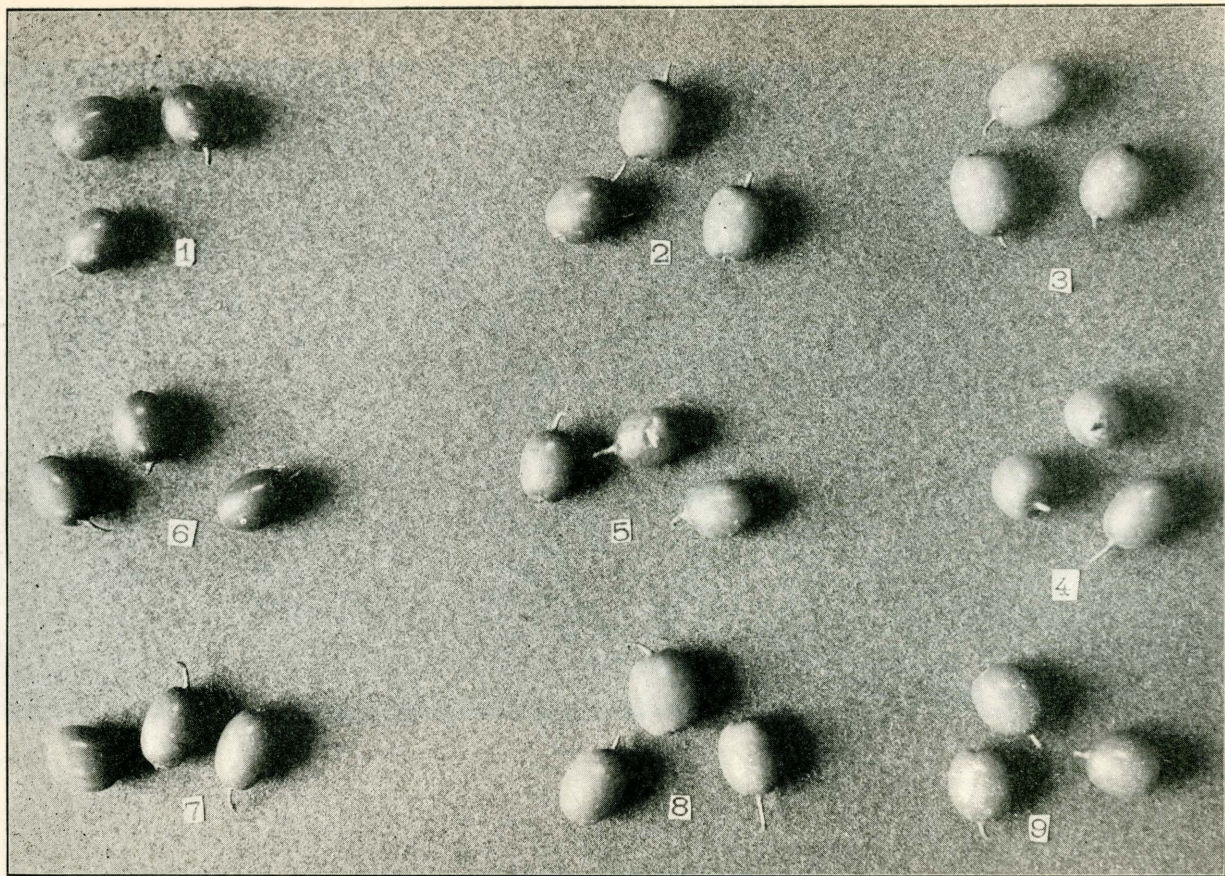


Plate 21—Showing range of variation in the first generation plants of the Siberian Sandthorn (*Hippophae rhamnoides*). The original plants came from Irkutsk, Siberia.



Plate 22—A field of two-year plants of 2,600 wild South Dakota black currants and gooseberries of the second generation under cultivation.

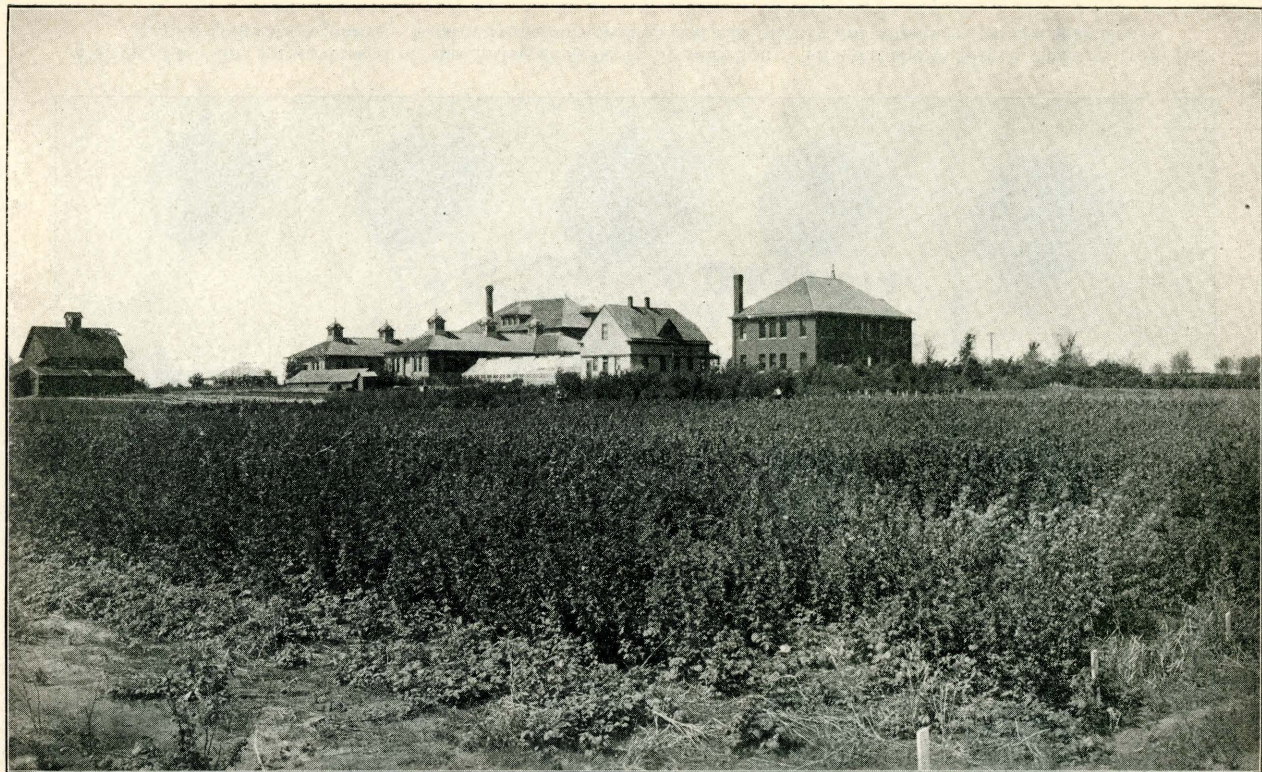


Plate 23—A field of 2,600 wild South Dakota black currants and gooseberries of the second generation under cultivation. The plants are in their fourth year, seed from the best have been selected and the old bushes are now ready for removal.



Plate 24—The improvement of the native gooseberry by selection. This cut shows fifteen varieties from the second generation plants. Productiveness as well as size and quality are considered in the selection.

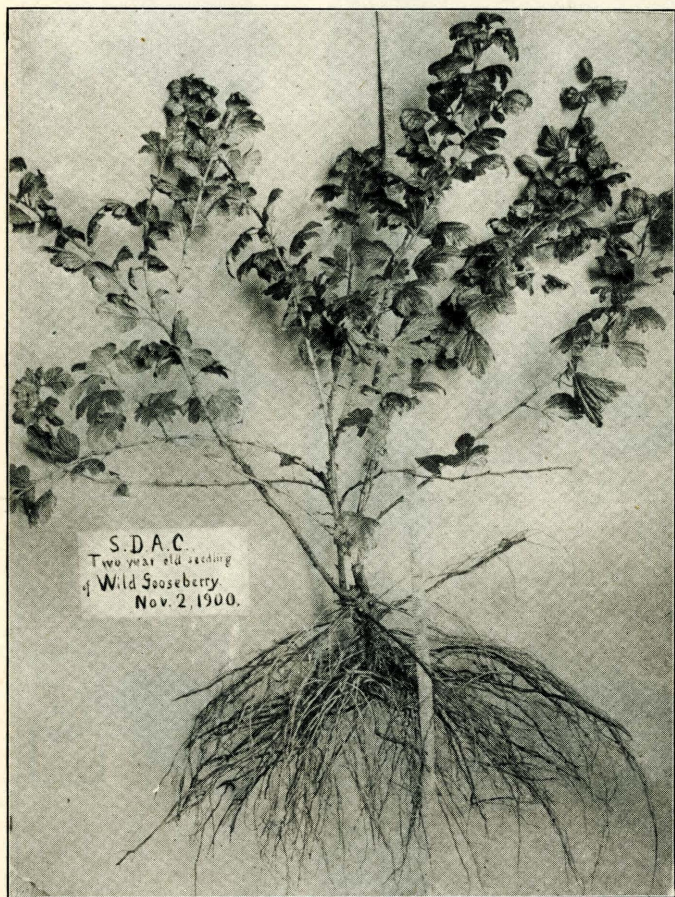


Plate 25—A plant of the native gooseberry (*Ribes gracile*) at the end of its second year November 2, 1900. The plant was dug carefully and the earth washed from the roots showing the strong development of the root system. Our native gooseberry and black currant are both worthy of being improved. Many of the early settlers in fact found them worthy of a place in the prairie garden even in their present stage of evolution.

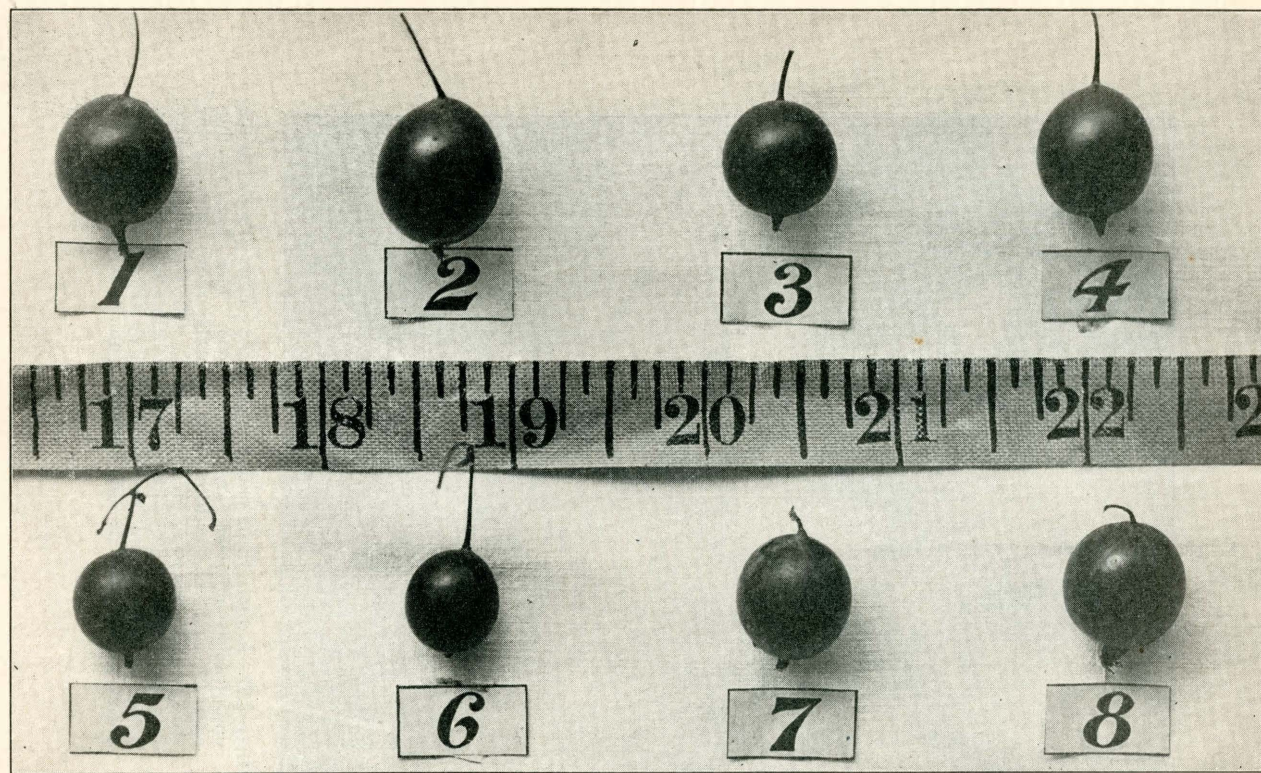


Plate 26—Showing fruit of eight selected varieties of wild black currant from plants of the second generation under cultivation.



Plate 27—A plant of the native black currant (*Ribes floridum*) as found native in South Dakota. The plant is shown as dug at the close of the second season, November 2, 1900, and with earth washed carefully from the roots showing a strongly developed root system. This illustrates one of my methods of applying the principle laid down by Darwin: "Excess of food causes variation." The selected seeds are sown in flats, transplanted to other flats and pots, as soon as well established are planted in the field. The plants are well manured and cultivated and given rich soil. From seedlings fruited in this manner the best are selected as the parents of the next generation plants.

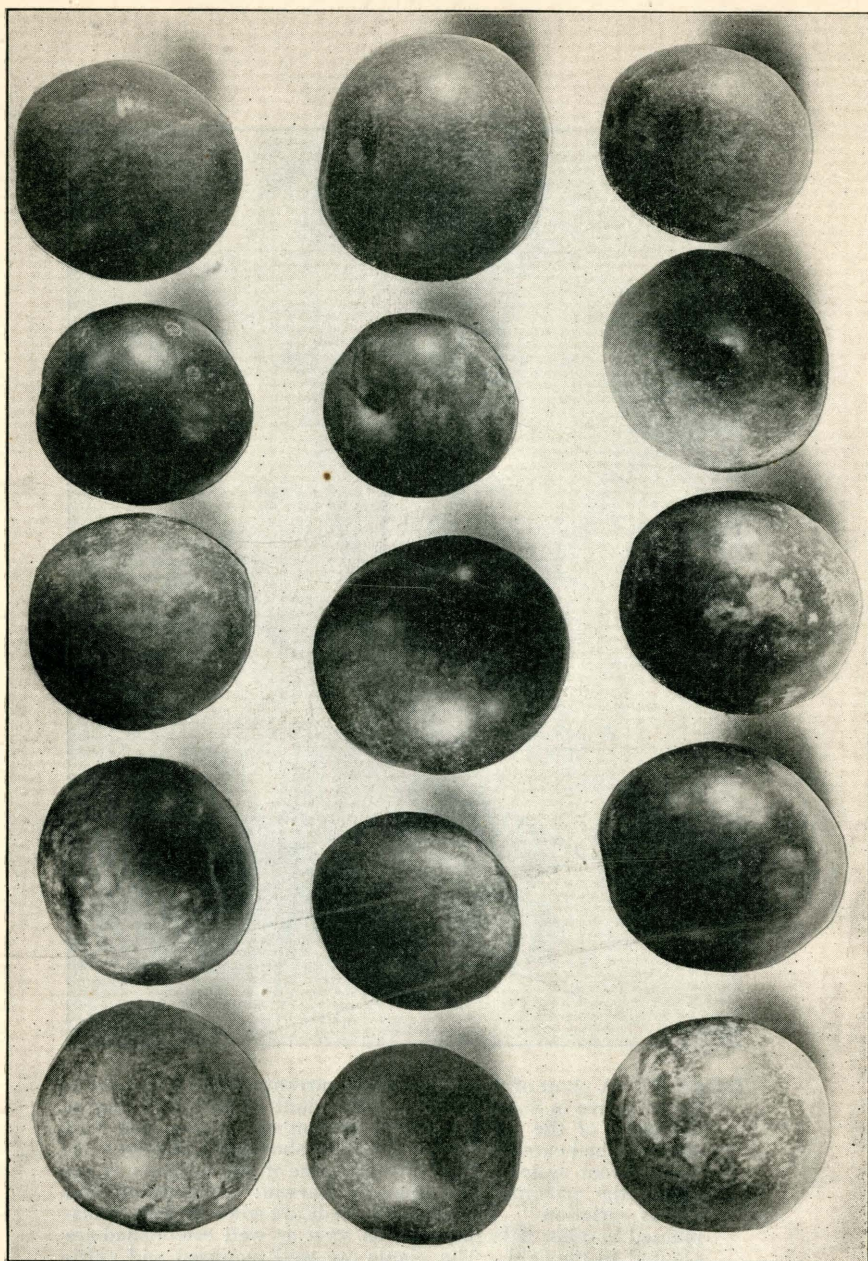


Plate 28—The Wolf Plum and fourteen of its seedlings.

Read downward.

Left Row.

F
No. 10
E
H
D

Middle Row.

A
P
Wolf
I
M

Right Row.

N
C
O
No. 6
K

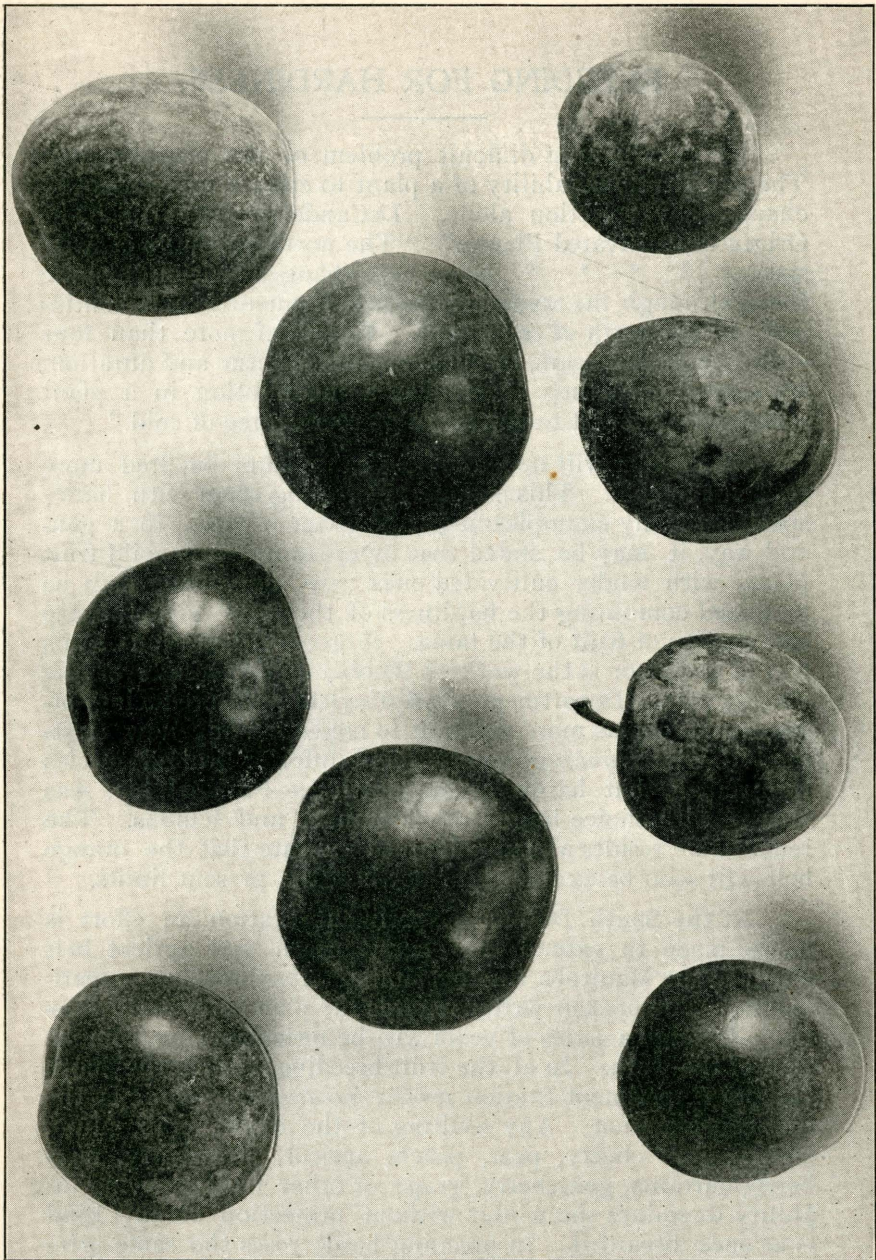


Plate 29—State Fair Seedlings. September 9, 1902. Raised from prize
State Fair plates. Read downward.

Left Row.

36
4
19

Middle Row.

16
24

Right Row.

6
38
12
34

BREEDING FOR HARDINESS.

This is the most difficult problem of the plant-breeder. The constitutional ability of a plant to endure cold cannot be changed by selection alone. DeCandolle writes in "The Origin of Cultivated Plants:" "The northern limits of wild species * * * * have not changed within historic times although the seeds are carried frequently and continually to the north of each limit. Periods of more than four or five thousand years, or changements of form and duration, are needed apparently to produce a modification in a plant which will allow it to support a greater degree of cold."

The reader will now ask how can plants be bred more resistant to cold. This is done by crossing them with hardy species. Many examples might be given of this. In a general way, it may be stated that by crossing hardy wild fruit plants with tender cultivated ones new individuals may be produced combining the hardiness of the wild with the size and quality of fruit of the tame. A good illustration of this line of endeavor is the work of Webber and Swingle of the United States Department of Agriculture in producing oranges and lemons more resistant to cold than any now existing. *Citrus trifoliata*, a very small inferior fruited species from Japan, but hardy as far north as Philadelphia, was crossed with choice large fruited oranges and lemons. The remarkable results already obtained indicate that the orange belt will soon be extended far north of the present limits.

At the South Dakota Experiment Station an effort is being made to extend the cherry, peach and apricot belt north to the Manitoba line by similar cross-breeding experiments. The present writer regards the plan as entirely feasible, although a series of years will be necessary for completion of the work. In all the fruit-breeding work at the South Dakota Experiment Station *perfect hardiness of plant* is the first consideration. Any seedling of the apple, crab, plum, cherry, sand cherry, pear, peach, apricot, strawberry, raspberry, currants, gooseberry, grape, or other fruit showing inability to endure the winter without protection of any kind is at once discarded. In breeding hardy roses the same principle is followed. In the work with vegetables the endeavor is to select for as great a degree of earliness as is consistent with a fair crop.